Eleven Shades of Grey: Trends in Color in the MIT Student Lending Art Collection

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Abstract

The average color of the universe has been determined to be beige. With this concept in mind, we seek to determine the average color of the MIT Student Lending Art Collection, with more than 700 pieces. We also seek to find the average color by decade of the collection's pieces in order to find if changes (if any) in the average color of the pieces created throughout time can be seen as a reflection of progress in society or technology. The average color was found by implementing the RGB model of color identification, which allowed for numerical methods to be used. We found that the average color was grey and that in the 1940s the pieces were at their darkest shade of grey. Considering factors in human history and factors in methods of photography and painting, we may say that such changes in the shade of grey reflected changes in human society.

Summary

We know that scientists have previously found that the average color of the universe is beige. Inspired by this, we sought to find the average color of the MIT Student Lending Art Collection by representing the average color of each piece numerically. We also sought to examine the changes in color throughout the decades, and overall it was found that the average color was grey, while throughout the decades, darker shades of grey accompanied darker periods of human history.

1   Introduction

It has been previously established that the average color of the universe is beige [1]. Inspired by such a concept, we devise a method to find the average color of available pieces in MIT's Student Lending Art Collection [2]. Additionally, as the collection contains over 700 pieces of art, we attempt to find whether or not a trend exists over time in the average color of the available pieces of each decade from 1920 to 2020 in order to see if any existing trends reflect historical or technological changes. Though representing a piece as its average color removes many of its complexities and nuances, such a simplification may allow us to more easily categorize pieces and see changes over time. The average color is found based on principles of the RGB color model (shown in fig. 1), which assigns a value between 0 and 255 for the three primary colors of light: red, green, and blue. Thus, a numerical way to devise the average color for a single painting or whole collection is possible, based on averaging the values of the three separate components of color.
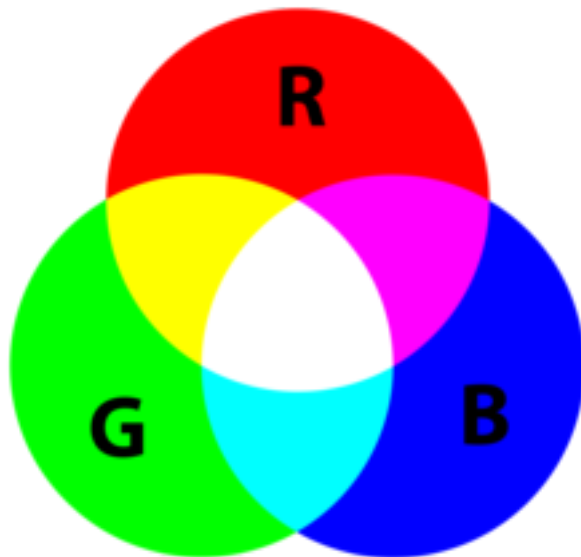

Figure 1: The three primary colors of light (red, green, and blue) are present in varying degrees in each visible color. [3]

2 Methods

First, the data was collected by noting the year in which each piece was created, along with its image address. Such a collection of data was then analyzed using Python in Google Colaboratory with packages such as pandas [4]. By accessing each piece through its image address and averaging the RGB values for each pixel of the image, an average value for each of the colors are obtained, which can then be used to find the average color of the piece.

After collecting the RGB values for all 731 pieces with known dates of creation in the collection, the average of the RGB values can be taken once again to approximate the average color of the entire collection. Similarly, since the year of creation of each piece is known, we may also use the above averaging process to find the average color of the pieces of a specific decade. Thus, we may generate our estimation of the average color of the whole collection. Additionally, we may generate a second data set that contains only the decade label and the average RGB values of the pieces that were created in that decade. To relate the average RGB values back to the correct color, we implement an RGB to hexadecimal converter, which operates on the following formulas:

$$R/16 = x + y/16$$
$$G/16 = x' + y'/16$$
$$B/16 = x'' + y''/16$$

and produces the hexadecimal number `xyx'y'x"y"`, which is another way of describing the color. The colors were then reproduced and trends were able to be more easily seen.

3 Results

The average color of the entire collection is summarized by the RGB values in table 1.

Red	Green	Blue	Average Color
133.1	128.9	123.6	

Table 1: RGB values and average color of entire collection.

The average colors of the entire collection throughout the decades are shown in table 2, along with the corresponding colors.
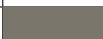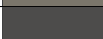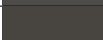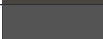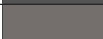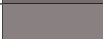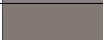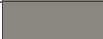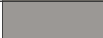
Decade	R	G	B	Color
1920s	123.5	118.6	107.5	
1930s	77.5	76.0	75.0	
1940s	72.2	70.0	65.3	
1950s	85.2	84.8	84.6	
1960s	116.6	111.8	108.8	
1970s	136.9	129.4	129.4	
1980s	130.4	122.0	117.3	
1990s	138.9	136.0	129.5	
2000s	132.8	127.9	119.5	
2010s	154.1	151.9	148.9	
2020s	140.1	138.9	127.2	

Table 2: RGB values and average colors of the pieces from each decade.

As the table shows, the darkest color was found in the 1940s, and so a t-test was run on the data from the 1940s and the most recent full decade, the 2010s. The p-values are shown in table 3 for the RGB values.

Color	t-value	p-value
Red	-3.37409	0.000485
Green	-3.52716	0.000289
Blue	-3.61856	0.00021

Table 3: P-values for the RGB values from the t-tests of 1940s and 2010s data.

4   Discussion

It was found that the average color of the entire collection is a moderate shade of grey. This can likely be attributed to the fact that many of the pieces in the collection are black-

and-white photos, as well as to the fact that many pieces with more striking colors also include neutral colors to produce a contrast. Thus, the average color has each of RGB values similar to one another.

In interpreting the differences in darkness throughout the decades, it was found that the darkest average color was found in the 1940s, as seen in table 2. This can perhaps be attributed to the fact that World War II was occurring during this time. Similarly, the relatively lighter color of the 1920s compared to the 1930s could be attributed to the "Roaring Twenties" in the 1920s and the Great Depression in the 1930s. Additionally, the dark colors in the decade following World War II and the subsequent lighter colors could be attributed to an overall lightening of the national mood. Also, since the p-values for each of the RGB values were found to be less than 0.05, we may say that the results are statistically significant.

In the future, one may choose to look at the average color of pieces from smaller increments of time. This may reveal more insights when aligned with recent history. Additionally, a factor that could be accounted for in the future is that the image of a particular piece might include its background, such as a wall, which would affect the average color. Finally, one should consider in the future that there were many different mediums and types of pieces in the collection, which may have affected the average color: for example, the numerous black-and-white photographs in the collection contributed to an average color of grey.

5   Acknowledgments

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References

[1] T. Rector, K. Arcand, and M. Watzke. *Coloring the Universe: An Insider's Look at Making Spectacular Images of Space.* University of Alaska Press, 2015.

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[4] T. pandas development team. pandas-dev/pandas: Pandas, Feb. 2020.